



The Role of Convection and Growth Competition in Phase Selection in Microgravity (LODESTARS)



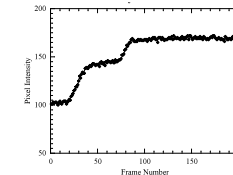
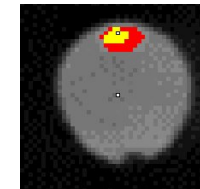
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DLR Team Coordinator: TBD

Marshall Space Flight Center

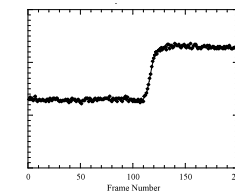
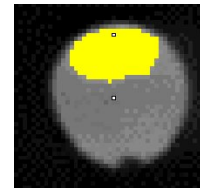
Ground-based Research (Electrostatic Levitator)

NASA Objectives and Contributions:

- ◆ Complex stainless steels can form a metastable dendritic ferrite phase, prior to the formation of the stable austenite phase.
- ◆ Determine governing factors behind kinetics of transformation in these commercially relevant structural materials
- ◆ Determine the effects of fluid flow in nucleation of the second phase, within the meta-stable phase in the mushy zone
- ◆ Correlate the local structure with containerless measurements of thermophysical properties



Austenite (yellow) growth from primary ferrite (red)



Austenite growth directly from supercooled liquid (grey)

ISS Resource Requirements

Accommodation (carrier)	Electromagnetic Levitator (EML) in Columbus Orbiting Facility
Upmass (kg) (w/o packing factor)	0.01 for samples
Volume (m³) (w/o packing factor)	10e-8
Power (kw) (peak)	TBD
Crew Time (hrs) (installation/operations)	2
Autonomous Operation	TBD
Launch/Increment	TBD

Relevance/Impact:

- ◆ Establish processing conditions for improving material properties and performance in cast austenitic stainless alloys
- ◆ Develop physical models to predict phase selection during strip casting. Endorsed by NUCOR Steel, Charlotte, NC.

Development Approach:

- ◆ Using containerless techniques establish a data base to test dendritic growth models over a wide range of undercoolings
- ◆ Determine the mechanism for stable phase nucleation by defining how convection influences the delay time over a broad range of fluid flow conditions
- ◆ Examine the relationship between alloy composition and transformation kinetics in these systems

Project Life Cycle Schedule

Milestones	SCR	RDR	PDR	CDR	VRR	Safety	FHA	Launch	Ops	Return	Final Report
Actual/ Baseline	09/02							2012			